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EXAMINER

ALANKO, ANITA KAREN

ART UNIT PAPER NUMBER

1765

DATE MAILED: 03/17/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary

Application No.

10/813,012

Applicant(s)

HORIGUCHI ET AL.

Examiner

Anita K. Alanko

Art Unit

1765

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 1/5/06 amdt.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-7 and 9 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-7 and 9 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☐ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date. _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

Claims 1-7 and 9 are rejected under 35 U.S.C. 103(a) as being unpatentable over Komura et al (US 5,423,921) in view of Giordani (US 6,833,079) and JP 03-196624A.

Komura discloses a method comprising:

etching a silicon layer (Si or SOI, col.3, lines 26-27) of an object 308 to be processed by employing a patterned mask (col.3, lines 29-30) and by using a plasma of a processing gas introduced into an airtight processing chamber, containing a gaseous mixture of HBr, O₂ and SiF₄, and additionally SF₆ (col.4, lines 8+, Table 1-Example 1),

wherein the patterned mask includes at least an oxide layer containing silicon (silicon oxide, col.3, lines 29-30).

Komura fails to disclose to further add a gas containing C and F.

Giordani teaches that it is useful to add a gas containing C and F (CF₄) to an SF₆ plasma gas to obtain a desired effect during etching (col.6, lines 30-32, 41-45).

JP 03-196624A also teaches to add a gas containing C and F to a plasma containing HBr in order to avoid excessive formation of sidewall protective film and achieve anisotropic etching (see abstract).

It would have been obvious to one with ordinary skill in the art to add a gas comprising C and F to the plasma of Komura because Giordani and JP 03-196624A teaches that to do so is useful to achieve a desired profile in the substrate.

The modified method of Komura inherently has the same results of preventing deposition or removing depositions at the openings of the patterned mask because, since the same method is conducted, the same results are expected.

As to claim 2, Giordani teaches to add CF₄.

As to claims 3-5, Giordani teaches to add them as desired during only certain steps (col.6, lines 35-40) depending on the desired effect that is desired. It would have been obvious to introduce the gas containing C and F as cited in the modified method of Komura because Giordani teaches that to do so is a known technique for achieving desired effects.

As to claim 6, the modified method of Giordani teaches to add the gas according to the desired effect, and this would encompass according to the diameter since one with ordinary skill in the art knows to vary the diameter of the opening according to the size of the etching opening desired.

As to claim 7, since the modified method of Giordani has the same steps as in the instant invention, it is expected to be capable and obvious to form the cited diameter opening according to the desired final product use.

As to claim 9, the modified method of Komura inherently has the same results of SiBrxOy deposits because, since the same method is conducted as in the instant invention, the same results are expected.

Response to Amendment

The claims remain rejected under 35 U.S.C. 103(a) as being unpatentable over Komura et al (US 5,423,921) in view of Giordani (US 6,833,079) and JP 03-196624A.

Response to Arguments

Applicant's arguments filed January 5, 2005 have been fully considered but they are not persuasive. Examiner acknowledges that Komura discloses that deposits are accumulated at the openings of the mask. However, Komura discloses to use a fluorine containing gas to remove those deposits, as in the instant invention. The instant invention discloses to add a C and F gas to the gas mixture, however this is obvious because Giordani and JP 03-196624 A both teach that it is useful to do this when etching silicon with bromine containing etchants in order to optimize the etched profile.

Applicants argue that there is no motivation to combine the teachings of Komura, Giordani and JP 03-196624. The motivation is that Giordani and JP 03-196624 both teach it is useful to add a carbon and fluorine containing gas when etching silicon with bromine containing

etchants in order to optimize the etched profile. Giordani teaches that control of anisotropic and isotropic etching is achievable by controlling the composition of the gas, and specifically teaches that CF₄ may be added to SF₆ to obtain a desired effect. JP 03-196624 teaches that a carbon and fluorine containing gas suppresses the excessive formation of a sidewall protective film (which inherently includes at the openings of the trench) in order to achieve an anisotropic etch. Thus at least two prior art references teach the conventionality of adding carbon and fluorine containing gases to bromine plasma etchants for etching silicon to achieve a desired profile.

The arguments about Giordani achieved a shaped profile are not commensurate in scope with the claim language. The claims are not directed to any particular profile.

The arguments about Giordani being directed to anisotropic and isotropic etching are not commensurate in scope with the claim language. The claims are not directed to anisotropic or isotropic etching.

The argument that neither Komura nor Giordani teaches or even suggests a method of forming fine deep holes or grooves of a high aspect ratio are not commensurate in scope with the claim language.

Examiner acknowledges that JP 03-196624 is directed to a photoresist mask, however this does not negate the teaching that it is useful to add a carbon and fluorine containing gas to a bromine containing plasma etchant for etching silicon. The primary reference is relied upon to teach the composition of the etch mask. Examiner does not agree that JP 03-196624 teaches away from the claimed invention. The claims are not limited to fine or deep holes with high aspect ratios, and the modified method of Komura inherently has removal or prevention of deposits, as discussed above in the rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a).

Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than **SIX MONTHS** from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Anita K. Alanko whose telephone number is 571-272-1458. The examiner can normally be reached on Mon-Fri until 2:30 pm (Wed until 11:30).

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Nadine Norton can be reached on 571-272-1465. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Anita K. Alanko

Anita K Alanko
Primary Examiner
Art Unit 1765